National Aeronautics and Space Administration
Goddard Space Flight Center
Contract No.NAS-5-3760

ST – CC – 10390

NASA TT F-9902

N65-33824

FACILITY FORM 602

(ACCESSION NUMBER) 5 (PAGES) (NASA CR OR TMX OR AD NUMBER)

(THRU) 1 (CODE) 24 (CATEGORY)

MEASUREMENT BY γ—SPECTROMETRY OF THE RADIOACTIVITY OF THE GRANÈS METEORITE FALLEN ON 13 NOVEMBER 1964

by

Daniel Nordemann
Jâcques Tobailem
Michele Schineizer

[FRANCE]

GPO PRICE $ _____

CSFTI PRICE(S) $ _____

Hard copy (HC) 1.00

Microfiche (MF) .50

ff 653 July 65

24 SEPTEMBER 1965

NASA TT F-9902
ST — CC — 10390

MEASUREMENT BY γ— SPECTROMETRY OF THE RADIOACTIVITY OF THE GRANÈS METEORITE FALLEN ON 13 NOVEMBER 1964 *

Comptes-Rendus de
l'Académie des Sciences
METEORITES,
T. 260, pp. 6664-6,
Paris, 21 June 1965

by Daniel Nordemann
Jacques Tobailem
Michèle Schneizer

33824

SUMMARY

The activities of the γ — emitters, present in a 1.186 kg sample of the Granès (Aude) stone meteorite, have been determined by quantitative γ— spectrometry of weak proper motion. Author

* *

On 13 November 1964, at about 17 00 hours, a stone meteorite (chondrite) has fallen in the village of Granès, near Quillan (Aude). The total mass, recovered in several fragments, was of the order of 9 kg.

Thanks to M. Rémy of the Faculty of Sciences of Montpellier, a fragment of 1.186 kg could reach our laboratory only seven days after the fall. Nondesctructive γ — spectrometry measurements with high sensitivity were immediately undertaken.

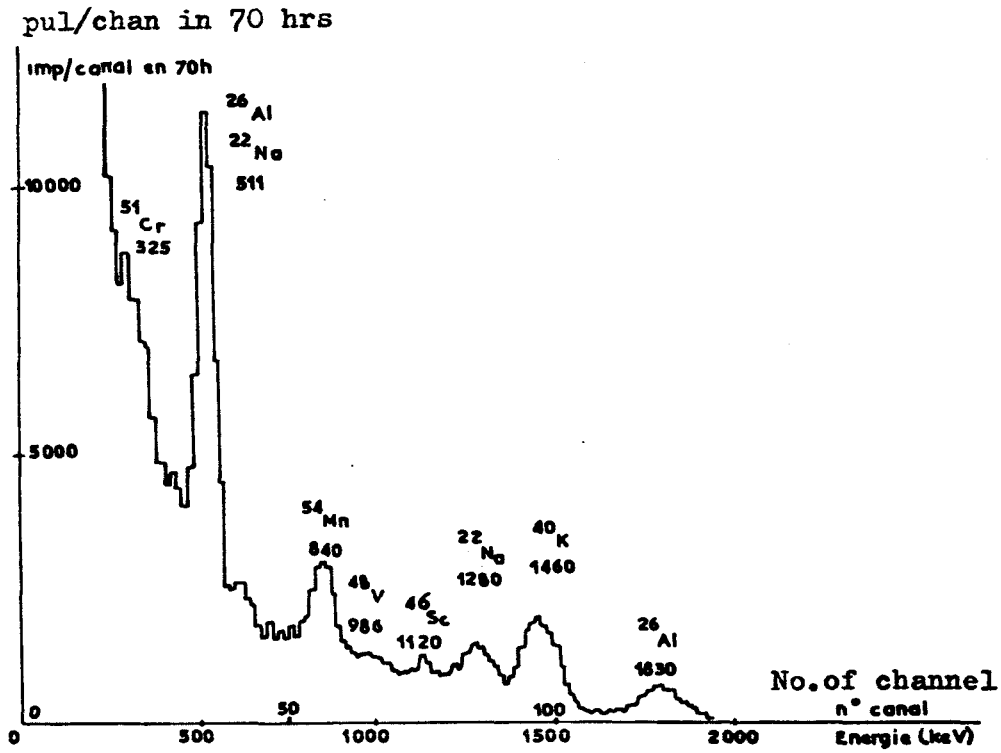
Such measurements have already allowed us to detect and determine the principal γ— emitting radioelements produced in the meteorites by action of cosmic radiation [1, 2].

The sample has been measured during four months by 10-hour intervals so as to ascertain the decay of short-lived radioactive elements. The figure, next page, shows one of the first spectrograms obtained.

---

* La radioactivité de la météorite Granès (chute du 13 novembre 1964) mesurée par spectrométrie γ.

The presence of aluminum 26, sodium 22, manganese 54, scandium 46 and potassium 40 is clearly ascertained by their characteristic photoelectric peaks.



Y — Spectrum of the Granes Meteorite.

(Fall of 13 November 1964, 70-hour measurement, having begun on 20 November 1964 on a sample weighing 1.186 kg, placed on a scintillation crystal NaI (Ti) of 10×8 cm dimensions; adjustment : 15 keV/channel.

Other emitters, of shorter periods, manganese 52, vanadium 48, chromium 51, cobalt 58, cobalt 56 are detected by the analysis of counting rate decrease in the different energy ranges. This procedure allows to separate in the photoelectric peaks the contributions of the emitters, whose periods are sufficiently short to offer an appreciable decrease in the course of measurement duration.

Owing to the calibration of the installation in the measurement conditions, these determinations are quantitative. —
This calibration was effected by means of calibrated sources of mercury 203, manganese 54, cobalt 60 and potassium 40, distributed in iron powder dummies simulating the shape and the electron density of the sample.

The results of the aggregate of measurements are compiled in the following table:

EMITTER		ACTIVITIES (dpm.kg^{-1}).	PRINCIPAL MODES OF FORM
^{52}Mn....	5,6 jours days	6 ±6	^{56}Fe(p, $2p3n$) ^{52}Mn; ^{54}Fe(p, $2pn$) ^{52}Mn
^{48}V.....	16,1 »	17 ±6	^{56}Fe(p, $4p5n$) ^{48}V
^{51}Cr.....	27,8 »	79 ±25	^{56}Fe(p, $3p3n$) ^{51}Cr
^{58}Co.....	71,3 »	20 ±5	^{58}Ni(n, p) ^{58}Co
^{56}Co.....	73,3 »		^{56}Fe(p, n) ^{56}Co
^{46}Sc.....	84,0 »	5,5 ±2	^{56}Fe(p, $6p5n$) ^{46}Sc
^{54}Mn.....	313,5 »	50 ±7	^{54}Fe(n, p) ^{54}Mn; ^{56}Fe(n, $p2n$) ^{54}Mn
^{22}Na.....	2,58 ans (years)	65 ±10	^{28}Si(p, $4p3n$) ^{22}Na
^{26}Al.....	7,38.10^5 »	81 ±10	^{28}Si(p, $2pn$) ^{26}Al; ^{56}Fe(p, $14p17n$) ^{26}Al
^{40}K.....	1,27.10^9 »	1565 ±75	Nucléosynthèse; [nucleosynthesis] ^{56}Fe(p, $8p9n$) ^{40}K; ^{40}Ca(p, n) ^{40}K

The radioelement ^{52}Mn, measured in the Granès meteorite in the course of the present work, had not yet been detected in the meteorites; this is due to its short period (5 — 6 days) and to the delays, separating the analyses from the fall. Its rate of activity can provide information on the recent past of meteorite's exposure to cosmic radiation.

The effective formation sections of manganese 52 and manganese 54 starting from iron have been determined in different irradiation conditions. Their ratio, as a function of proton energy, is : 0.39 at 730 MeV, according to Honda and Lal [3], and 0.50; 0.30; 0.37 and 0.37, respectively at 800, 1 500, 2 200 and 2 900 MeV after Rayudu [4]. These values imply that one should have been expecting to find an activity in manganese 52 at least equal to about one third of that of manganese 54, and this in case of a uniform irradiation after the fall of the meteorite. However, we found a ratio of activity ^{52}Mn/^{54}Mn equal to 0.12 ± 0.12. Thus it seems, that the Granès meteorite has been irradiated less strongly during the few days preceding its fall.

*** THE END ***

(Centre d'Études nucléaires de Saclay, Service d'Électronique physique, et Centre des Faibles radioactivités du C.N.R.S., Gif-sur-Yvette, Seine-et-Oise.)

REFERENCES

[1].- D. NORDEMANN ET J. TOBAILEM.- Comptes-Rendus, p. 3581 of T.259, 1964.

[2].- J. TOBAILEM ET D. NORDEMANN.- Geochimica and Cosmochimica Acta (print)

[3].- M. HONDA ET D. LAL. Nucl.Physics, 51, p.363, 1964.

[4].- G. V. S. RAYUDU.- Canadian J. of Chemistry (in print).

Contract No.NAS-5-3760
Consultants & Designers, Inc.
Arlington, Virginia

Translated by ANDRE L. BRICHANT
on 24 September 1965

DISTRIBUTION

GODDARD SPACE FLIGHT CENTER

100	CLARK, TOWNSEND	
110	STROUD	
400	BOURDEAU	
600	PIEPER	
610	MEREDITH	
611	McDONALD	
	GUSS	
	KNIFFEN	
	ABRAHAM	
	BOLDT	
612	HEPPNER	
	NESS	
613	KUPPERIAN	[3]
614	LINDSAY	
	WHITE	
615	BAUER	
	GOLDBERG	
	STONE	
640	HESS	[3]
	O'KEEFE	
630	GI for SS	[5]
252	LIBRARY	
256	FREAS	

NASA HQS

SS	NEWELL, NAUGLE	
SG	MITCHELL	
	SCHARDT	
	DUBIN	
	ROMAN	
	SMITH	
SL	LIDDEL	
	BRUNK	
	BRYSON	
	FELLOWS	
	HIPSHER	
	HOROWITZ	
SM	FOSTER	
	ALLENBY	
	GILL	
	BADGLEY	
RR	KURZWEG	
RTR	NEILL	
ATSS	SCHWIND	[3]
	ROBBINS	
WX	SWEET	

OTHER CENTERS

ARC

SONETT	[5]
LIBRARY	[3]

LaRC

160	ADAMSON	
213	KATZOFF	
	DAVIS	
185	WEATHERWAX	[2]

JPL

NEWBURN
EIMER
SNYDER
SPEED
CONEL
KOVACH
LOOMIS

UCLA

COLEMAN
